

REMARKS

Favorable reconsideration in view of the previous amendments and following remarks is respectfully requested.

Claims 1, 7-9 and 11 are pending.

The Office Action rejects claims 1, 3-9 and 11 under 35 U.S.C. §103(a) over U.S. Patent No. 4,142,555 to *Satake et al.* in view of U.S. Patent No. 5,599,599 to *Mirmiran et al.* This rejection is respectfully traversed.

Applicant's independent 1 claim recites a fibre reinforced polymer outer tube including a majority of fibres oriented generally circumferentially around the fibre reinforced polymer outer tube; a steel inner tube, the steel inner tube being hollow; and a concrete filler material provided between the outer tube and the steel inner tube. These features encompass Applicant's exemplary embodiment illustrated in Fig. 1 wherein a double skin tubular structure member is provided having a fiber reinforced polymer outer tube 2 and an inner tube 3 made from generally metallic materials. A filler material including a bound aggregate material is provided between the outer tube 2 and the inner tube 3.

Satake discloses a steel pipe 1 having a primer applied to its surface. A corrosion preventive material 3 is then applied and a composite material 4 consisting of a corrosion preventing material and reinforcing material are in turn applied thereon. In terms of objectives, *Satake* provides a coating layer to prevent a metal pipe from corrosion. The coating layer must be very thin (about 3 mm in the examples given) and be able to cure rapidly (within 30 to 120 seconds). A primer layer may be needed between the coating layer and the metal pipe to improve bonding. In addition, a very thin external cloth or sheet (not always needed) may be

used to provide surface protection to the coated metal pipe. If the metal pipe is used to resist any external loading, it is only the metal pipe itself that provides the load resistance.

In claim 1, the steel inner tube, the concrete layer (the filler material) and the FRP (fibre reinforced polymer) outer tube work together to resist external loading in a robust and ductile manner. Each of the three components plays a useful role in the load resistance mechanism. The main functions of the three components are as follows: the concrete resists axial compression, the steel tube resists both axial compression and axial tension, and the FRP tube confines the concrete so that the ductility and strength of the concrete are enhanced. This load resistance function cannot be achieved by Satake.

In Satake, the metal pipe is the innermost layer, and this is followed by a possible (but not essential) primer layer, then by the corrosion-preventive coating layer, and then by a possible (not always present) cloth/sheet which may be a glass cloth. It should be noted that the corrosion-preventive coating layer generally includes a number of sub-layers, in the order of a sub-layer without reinforcing solid particles and then a sub-layer with reinforcing solid particles for enhanced abrasion and impact resistance, and then possibly another layer without reinforcing solid particles. It must be noted the "filler" in Satake refers to the solid particles and not the entire coating layer.

Therefore, if the external glass cloth is not used, the coated metal pipe of Satake does not have an outer tube as in claim 1. Instead, it only has the inner metal pipe plus the coating layer (the primer is an optional layer between the metal pipe and the corrosion-preventive coating layer). The reinforced polymer sub-layer

of the coating layer cannot be compared with the FRP outer tube in claim 1 as the solid particles do not provide the circumferential force resistance of the hoop fibers in the FRP outer tube of claim 1.

If the external sheet is a glass cloth and is present, there are very clear differences between the objectives and substances of the two inventions such that a person skilled in the art would not be motivated to replace the coating layer of the Satake invention with a layer of concrete and the glass cloth of the Satake invention with an FRP outer tube with fibers mainly in the hoop directions as explained below.

Satake is directed to the coating of a metal pipe to prevent corrosion. This coating material must be able to cure rapidly to shorten the time from coating to handling, which is the first objective and the main advantage of the Satake invention. Satake teaches that the coating needs be applied using an airless spray gun and needs to harden "in about 15-180 seconds, normally 30 to 120 seconds". Indeed, the invention teaches careful design of the two ingredients of the coating material in terms of the weight percentages.

The compositions of the two ingredients are clearly taught by Satake invention, which excludes concrete as a possible corrosion-preventive material for its purpose. As a result, a person skilled in the art would not be motivated to replace the coating layer Satake with a concrete layer as used in claim 1 as the rapid curing requirement is the main advantage of Satake and the use of concrete will completely defeat the purpose of the Satake invention. Concrete will take days (up to 7 days) to cure instead of 30 to 120 seconds as taught by Satake.

Another disadvantage with the replacement of the corrosion-preventive coating layer with a concrete layer is that the concrete will be much thicker and

heavier so that the weight of the coating can become comparable to the pipe itself. In the three examples cited in the Satake invention for pipes with diameters of 600 mm, 1000 mm and 1200 mm (these are similar to the diameters of large structural members), the corrosion-preventive material is applied in sub-layers of around 700-800 micrometers, so the total thickness of the coating layer is less than 3 mm. In a concrete layer, the maximum aggregate size is typically 20 mm, and a concrete layer for corrosion protection of a metal pipe normally needs to exceed 30 mm in thickness. The weight of the concrete layer is similar to the weight of a 10 mm thick steel pipe. Therefore, a concrete layer for corrosion prevention would double the weight of a steel pipe.

Even such a concrete layer is unlikely to provide the same degree of corrosion protection to the metal pipe as concrete is not a good corrosion-preventive material.

Third, the corrosion-preventive coating layer needs to be well bonded to the metal pipe as taught by the Satake invention and that is why the use of blast-gritting and primer is recommended to prepare the metal pipe before the application of the corrosion-preventive coating layer. The use of a concrete layer will mean that there will be poor bonding between the concrete layer and the metal pipe and the concrete layer can easily peel off under operational conditions. In claim 1, the concrete is contained by a strong FRP outer tube and good bonding between the concrete layer and the steel tube or the FRP outer tube is not required as long as the three components remain in tight contact. Therefore, a person skilled in the art would not be motivated to replace the corrosion-preventive coating layer with a concrete layer.

Satake teaches the use of a very thin external sheet to be applied to the coating layer for surface protection when necessary. It must be noted that this external sheet is optional in the Satake invention.

In Satake, the external cloth is for protection of the outer surface of the coated metal pipe. In claim 1, the FRP outer tube is for the confinement of the concrete layer. In claim 1, the concrete layer may expand under axial stresses and this expansion is contained by the FRP outer tube. This confinement of the concrete leads to significant increases in the axial compressive strength and ductility of the concrete layer. As a result, this FRP outer tube needs to be strong and have fibers in a direction to achieve this strength. In Satake, only a very thin external sheet is needed as it is only for surface protection. The FRP outer tube of claim 1 would be much more expensive to manufacture in Satake due to the use of a much larger thickness and a much larger amount of glass or other fibers than the external sheet so a person skilled in the art would not be motivated to use such an FRP outer tube as the external protective sheet in the Satake invention. Indeed, in Satake invention, this external sheet is not always needed, depending on applications.

Finally, in a non-limiting example of the present invention, the FRP outer tube functions as a form during construction for the casting of wet concrete. that is, the FRP outer tube is fabricated before the casting of concrete. In Satake, the thin external sheet is applied on the coating layer after the coating layer has been applied. The construction procedures are fundamentally different.

Thus, Applicant respectfully requests withdrawal of the rejection of claim 1. Claim 9 is allowable for reasons similar to those presented above with respect to claim 1.

Should any questions arise in connection with this application or should the Examiner believe that a telephone conference with the undersigned would be helpful in resolving any remaining issues pertaining to this application, the undersigned respectfully requests that he be contacted at the number indicated below.

Respectfully submitted,

BUCHANAN INGERSOLL & ROONEY PC

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